PTO 09-7947

CC=JP DATE=20020228 KIND=A
PN=2002060927

# MASK FOR PATTERNING THIN FILM DEPOSITION
[Hakumaku Patan Seimakuyo Masuku]

Hisaya Nakagawara, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. September 2009

Translated by: FLS, Inc.

| | |
|---|---|
| PUBLICATION COUNTRY | (19): JP |
| DOCUMENT NUMBER | (11): 2002-060927 |
| DOCUMENT KIND | (12): A |
| | (13): PUBLISHED UNEXAMINED APPLICATION (Kokai) |
| PUBLICATION DATE | (43): 20020228 |
| PUBLICATION DATE | (45): |
| APPLICATION NUMBER | (21): 2000-242531 |
| APPLICATION DATE | (22): 20000810 |
| INTERNATIONAL CLASSIFICATION | (51): C23C 14/04; // C23C 16/04 |
| INVENTORS | (72): NAKAGAWARA, HISAYA; OGAWA, MASAYUKI |
| APPLICANT | (71): TORAY INDUSTRIES, INC. |
| TITLE | (54): MASK FOR PATTERNING THIN FILM DEPOSITION |
| FOREIGN TITLE | [54A]: HAKUMAKU PATAN SEIMAKUYO MASUKU |

[Claims] /2*

[Claim 1] A mask for patterning thin film deposition, wherein, in addition to true pattern openings, dummy openings are further provided at the periphery thereof and wherein the occupancy rate of the dummy openings in said mask is in the range of from 2 to 20 %.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention pertains to a mask for patterning thin film deposition.

[0002]

[Related Art] TFT color liquid-crystal displays have a color filter at a position that faces the liquid crystal layer. On this color filter, a transparent conductive thin film, a representative example of which is ITO film, is formed so as to drive the liquid crystal. Sputtering is a common technique used for forming this film, and the masking-sputtering technique, which deposits and forms a desired thin film pattern on a color filter using a metal mask, is known as a conventional technique.

[0003]

[Problems that the Invention Intends to Solve] However, when a conventional metal mask is used to deposit ITO film, which is a type of transparent conductive film, on a multi-processing color filter, such as one that has 6 pattern panels or more per substrate, the metal

* Claim and paragraph numbers correspond to those in the foreign text.

mask is deformed during the deposition due to the thermal expansion of the metal mask, thereby deteriorating its adhesion with the color filter; as a consequence, the color filter after the deposition has a deposition defect called pattern unsharpness, which is a phenomenon in which the boundary of the ITO film becomes blurry, thus presenting the problem that a desired thin film pattern cannot be obtained. The accuracy of ITO film pattern deposition is one of the important quality factors for color filters, and, if the deposition accuracy is poor, it could cause the resulting liquid crystal display to have display defects.

[0004] The present invention intends to solve the aforesaid problems of the conventional art and thereby to provide a mask for patterning thin film deposition that makes it possible to form a desired thin film pattern, especially on a multi-processing color filter, like the one described in the foregoing, and thereby to produce an excellent color filter.

[0005]

[Means for Solving the Problems] The mask for patterning thin film deposition pertaining to the present invention is characterized by the fact that, in addition to true pattern openings, dummy openings are further provided at the periphery thereof and by the fact that the occupancy of the dummy openings in said mask is in the range of from 2 to 20 %.

[0006] These dummy openings serve to absorb the thermal expansion of the mask during the thin film deposition and maintain the adhesion between the mask and the color filter, thereby making it possible to obtain a color filter with no deposition defects.

[0007]

[Mode of Implementing the Invention] The present invention is characterized by the fact that a mask for patterning thin film deposition has, in addition to true pattern openings, dummy openings provided in the periphery thereof. Further, it is characterized by the fact that the occupancy of the dummy openings in said mask is in the range of from 2 to 20 %.

[0008] The dummy openings are provided on the exterior side of the substrate sections at which cuts will be made. The suitable mask-area occupancy of the dummy openings is from 2 to 20 %. If it is less than 2 %, the dummy openings do not fulfill their role of absorbing thermal expansion, and pattern unsharpness occurs, thus rendering this range undesirable. If it exceeds 20 %, the mask tends to deform when the deposited film is repeatedly cleaned by blasting, and the flatness of the mask is lost, thus rendering this range undesirable. It is more desirable for the mask-area occupancy of the dummy openings to be from 9 to 11 %.

[0009] Because the thin films deposited at the dummy opening portions are located at the sections to be eliminated by cutting in the backend process, they present no problem to the resulting product.

[0010] The material of the mask for thin-film deposition use pertaining to the present invention is preferably such metal as stainless steel, 42 alloy, or the like for ease of handling and for making repeated use possible.

[0011]

[Working Examples] Working Example 1

As a working example of the present invention, the following will present a case of depositing an ITO film, which is a type of transparent conductive film, on a 3.5-inch x 20-panel-processing color filter.

[0012] Fig. 1 is a structural drawing of the mask for patterning thin film deposition described in the working example of the present invention, said drawing illustrating the mask before the deposition, and Fig. 2 is a structural drawing of the mask in Fig. 1 after the deposition.

[0013] This color filter was intended to be cut from the 360 x 465 mm size to 320 x 400 mm size after the deposition of ITO film. The 320 x 400 mm color filter pattern was located at the center portion of the 360 x 465 mm substrate before the cutting.

[0014] First, the structure of the present invention's mask for patterning thin film deposition will be described. As illustrated in Fig. 1, true color filter pattern openings (2) were formed in a stainless steel plate that was 360 mm long, 470 mm wide, and 2 mm

thick. Thereafter, dummy openings (3) were formed at the periphery thereof, thus preparing a mask (1) for patterning thin film deposition.

[0015] Here, the mask-area occupancy of the color filter pattern openings (2) was approximately 50 %, and the mask-area occupancy of the dummy openings (3) was 10 %.

[0016] Next, using this mask (1), patterns composed of ITO film were deposited on a 3.5-inch x 20-panel-processing color filter substrate (4), as shown in Fig. 2. The ITO film-forming method used here was sputtering. The deposition conditions were: pressure, 0.2 Pa; temperature: 200 °C; and thickness: approximately 140 nm.

[0017] The appearance after the ITO film deposition was inspected, and, as a result, it was confirmed that all the deposited patterns were formed at the prescribed positions with no deposition defect, such as unsharpness or the like.

[0018] Using this mask, 200 color filters were processed, but no deposition defect, such as unsharpness or the like, was found.

[0019] After the deposition of ITO film, the 360 x 465 mm substrate was cut to 320 x 400 mm in the cutting process. Because the mask was so designed as to eliminate the dummy film-deposition portions (7), in which the film was deposited through the dummy openings (3) of the mask (1), in this cutting process, these portions did not pose any problem to the final product.

[0020] Comparative Example 1

In a stainless steel plate of the same size as that in the working example were formed pattern openings (2) alone, thereby preparing a thin-film deposition mask, and ITO film was deposited on the same color filters as those used in the working example under the same conditions. Deposition was conducted on 100 filters, and, as a result, nearly all filters showed some type of deposition defect, such as pattern unsharpness or the like. The pattern unsharpness was found more frequently at the center section of the substrate.

[0021] Comparative Example 2

In a stainless steel plate of the same size as that in the working example were formed pattern openings (1 [sic]), after which dummy openings whose mask-area occupancy was 21 % were provided, thereby preparing a mask, and ITO film was deposited on the same color filters as those used in the working example under the same conditions. As a result of depositing on 24 filters, no pattern unsharpness was found, but 11 filters, which were about a half of all the filters, had scratches caused by the contact with the mask. Because the mask-area occupancy of the dummy openings was too large, the mask strength decreased, and the mask was deformed and lost its flatness; consequently, the pattern edge and substrate made contact and caused scratches.

[0022]

[Effects of the Invention] With the present invention, in the process of depositing transparent conductive thin films on color

filters, the deposition can be accomplished without causing deposition defects, such as pattern unsharpness or the like, and, furthermore, color filters having excellent quality can be obtained. Its effect is especially prominent in the process of depositing transparent conductive thin films onto multi-processing color filters that yield 6 or more panels per 1 substrate.

[Brief Explanation of the Drawings]

[Fig. 1] A structural drawing of the thin-film deposition patterning mask described in the working example of the present invention, said drawing illustrating the mask before the deposition.

[Fig. 2] A structural drawing of the thin-film deposition patterning mask described in the working example of the present invention, said drawing illustrating the mask after the deposition.

[Explanation of the Reference Numerals]

1: Deposition patterning mask

2: Pattern opening

3: Dummy opening

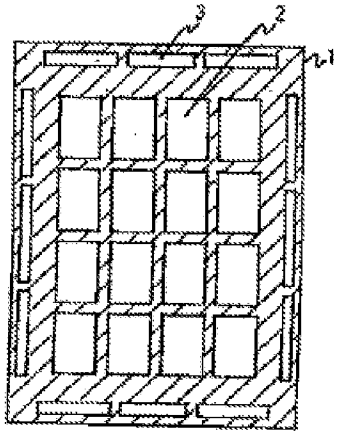
4: Substrate (mother substrate)

5: Color filter (pattern deposition section)

6: Cutting line

7: Dummy deposition section

[FIG. 1]




[FIG. 2]